

### REMARKS

Claims 1-25 and 30-34 and 37-40 are all the claims presently pending in the application. Claims 2-7, 9-11, 13-27 and 30-34 have been withdrawn from prosecution as allegedly directed to a non-elected species. Claims 26-27 and 35-36 have been canceled. Claims 37-40 have been added.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 1 and 8 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Daughton (U. S. Patent No. 6,744,086) in view of Chen et al. (U.S. Patent No. 5,917,749). Claim 12 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Daughton and Chen and further in view of Nakada et al. (U.S. Patent No. 6,341,053).

These rejections are respectfully traversed in view of the following discussion.

#### **I. THE CLAIMED INVENTION**

Applicant notes that the features of the exemplary aspects of the claimed invention which are described in this Amendment may pertain only to those particular aspects of the claimed invention. These features are not necessarily included in other aspects of the invention and, therefore, the description of such features in this Amendment should in no way be considered as limiting other aspects of the invention which may be disclosed in the present Application or which may be the subject of other patents or patent applications.

The claimed invention, as exemplarily described by independent claim 1, is directed to a spin-current switched magnetic memory element, including a plurality of magnetic layers, **at least one of said plurality of magnetic layers having a perpendicular magnetic anisotropy component and having a current-switchable magnetic moment**, and at least one barrier layer formed adjacent to said plurality of magnetic layers.

In conventional magnetic memory elements, the threshold current is too high (e.g., by at least an order of magnitude) for successful insertion into current generation complementary metal oxide semiconductor (CMOS) circuits (Application at page 2, lines 5-8).

The claimed invention, on the other hand, includes a plurality of magnetic layers, at least

one of the plurality of magnetic layers having a **perpendicular magnetic anisotropy component and having a current-switchable magnetic moment** (Application at page 8, lines 9-15). That is, unlike conventional magnetic memory elements, the claimed invention may **utilize the perpendicular magnetic anisotropy component observed in some magnetic thin films to at least substantially offset (e.g., counter-balance) the strong demagnetization effect  $4\pi M_s$** , thus removing the main barrier for current induced magnetic reversal, and reduce the switching current threshold (Application at page 9, line 22-page 10, line 4).

## II. THE ALLEGED PRIOR ART REFERENCES

### A. Daughton and Chen

The Examiner alleges that Daughton would have been combined with Chen to form the invention of claims 1 and 8. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Daughton discloses a current switched magnetoresistive memory cell, which includes a memory film of an anisotropic ferromagnetic material and a source layer positioned on one side thereof so that a majority of conduction electrons passing therefrom have a selected spin orientation to be capable of reorienting the magnetization of the film (Daughton at Abstract.

Chen discloses an MRAM cell including two layers of magnetic material stacked in a parallel, overlying relationship and separated by a layer of non-magnetic material so as to form a portion of a memory cell. At least one of the two layers of magnetic material have a magnetic anisotropy generally parallel to the width of the layers of magnetic material (Chen at Abstract).

However, Applicant respectfully submits that these references are unrelated and would not have been combined as alleged by the Examiner. Thus, no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that there is no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Specifically, Applicant respectfully submits that neither Daughton, nor Chen, nor any alleged combination thereof teaches or suggests "*a plurality of magnetic layers, at least one of*

*said plurality of magnetic layers having a perpendicular magnetic anisotropy component and comprising a current-switchable magnetic moment* ", as recited, for example, in claim 1.

Clearly, this feature is not taught or suggested by Daughton. Indeed, the Examiner concedes that Daughton does not teach or suggest this feature on page 4 of the Office Action. The Examiner alleges that Chen teaches this feature, but the Examiner is incorrect.

Applicant would again point out that Chen's device is structurally different from the claimed invention (e.g., claim 1), in that Chen's current is not "spin-polarized". Indeed, Chen never teaches or suggests the nature of his current in terms of its spin-polarization. Chen teaches that the current flows near or passes by one of the magnetic layers only to generate a magnetic field. **Chen's current for switching operation does not pass through the "stack" containing the magnetic tunnel junction.** That is, Chen does not teach or suggest a current-switchable (e.g., **spin-current switchable**) magnetic moment.

In the claimed invention, however, a spin-current, or spin-polarization may be induced by passing the current through the magnetic layers (e.g., the stack containing a magnetic tunnel junction). The claimed invention may use a spin-current to switch a nanomagnet, which could in fact be generalized to device geometries where the spin-current is generated elsewhere. Fundamentally, the current in the claimed invention may **use spin to induce a magnetic switch.**

Chen's current, on the other hand, **generates a magnetic field which then induces magnetic switch.** This is completely different than the claimed invention.

That is, a magnetic memory element (e.g., nanomagnet) that is switchable by a **spin-polarized current** (or "spin-current" as recited in claim 1) is a fundamentally different device than those switchable by a **magnetic field** induced by passing a current in close proximity, or in some instances, directly through, the switching nanomagnet. These involve two fundamentally different physical processes, and two classes of fundamentally different device structures, to which numerous publications and patents can attest.

Thus, nowhere does Chen teach or suggest a plurality of magnetic layers, **at least one of the plurality of magnetic layers having a perpendicular magnetic anisotropy component and having a current-switchable magnetic moment.** Therefore, Chen does not make up for the deficiencies of Daughton.

Therefore, Applicant again submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every feature of the

claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

**B. Nakada**

The Examiner alleges that Daughton and Chen would have been further combined with Nakada to form the invention of claim 12. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Nakada discloses a magnetic tunnel junction device which includes a stack of multi layers which include a pinning layer, free layer a tunneling barrier layer, a pinned layer and a second pinning layer (Nakada at Abstract).

Applicant respectfully submits that these references are unrelated and would not have been combined as alleged by the Examiner. Thus, no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that there is no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Daughton, nor Chen, nor Nakada, nor any combination thereof teaches or suggests "*a plurality of magnetic layers, at least one of said plurality of magnetic layers having a perpendicular magnetic anisotropy component and comprising a current-switchable magnetic moment*", as recited, for example, in claim 1.

Clearly, this feature is not taught or suggested in Nakada.

In fact, Nakada simply discloses a magnetic tunnel junction process for read-out operation. The Nakada process could not be used, either separately or in combination, to allow a spin-current based "write" operation, which is what the claimed invention may involve.

That is, nowhere does Nakada teach or suggest a plurality of magnetic layers, **at least one of said plurality of magnetic layers having a perpendicular magnetic anisotropy component and including a current-switchable magnetic moment**. It is therefore impossible for a person skilled in the art to arrive at the claimed invention based on the teachings of Daughton, Chen and Nakada. Thus, Nakada clearly does not make up for the deficiencies in

Daughton and Chen.

Therefore, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every feature of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

### **III. FORMAL MATTERS AND CONCLUSION**

In view of the foregoing, Applicant submits that claims 1-25 and 30-34 and 37-40, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Assignee's Deposit Account No. 50-0510.

Respectfully Submitted,

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